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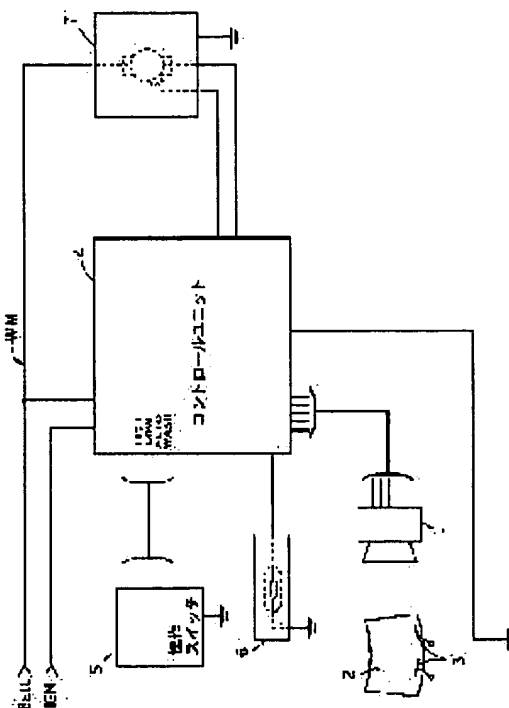
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## (54) RAINDROP DETECTING DEVICE FOR VEHICLE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To improve degree of freedom of design, economic efficiency and versatility by reducing restrictions on installation location and direction of an image pickup means and dispensing with a member for preventing the background of image from being taken in to enable use of the image pickup means for other applications.

**SOLUTION:** This raindrop detecting device comprises a CCD camera 1 provided for photographing the wiping range of a wiper 3 over a front window 2 of a vehicle from backward to forward, and a control unit 4 for detecting raindrops based on picked-up image data input from the camera 1. The control unit 4 compares image data picked up in the last control timing with image data picked up in the preceding control timing input from the camera 1 to determine raindrop quantity based on picked-up image data that coincides with each other between the former and the latter.



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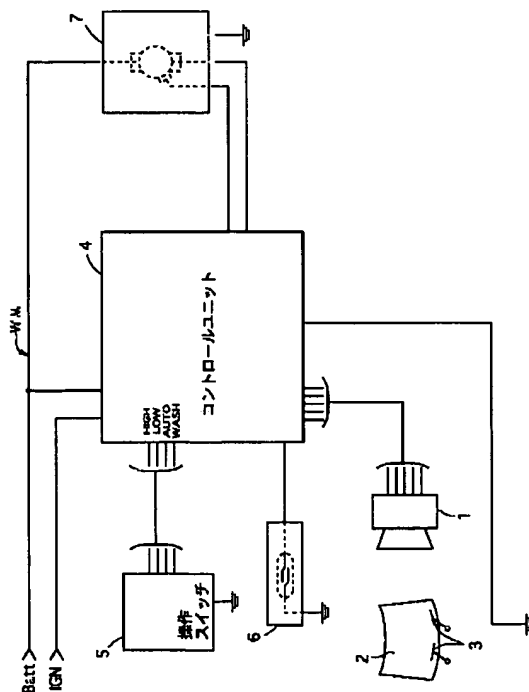
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(54) 【発明の名称】 車両用雨滴検出装置

(57) 【要約】

【課題】 撮像手段の設置位置ならびに設置方向の制約を少なくするとともに、映像の背景を取り込まないようにする部材を不要とすることで、撮像手段を他の用途にも用いることを可能とし、設計自由度の向上を図るとともに、経済性ならびに汎用性の向上を図ること。

【解決手段】 車両のフロントウインド2におけるワイパ3の払拭範囲を後方から前方に向けて撮影可能なCCDカメラ1が設けられ、カメラ1から入力される撮像データに基づいて雨滴を検出するコントロールユニット4が設けられ、コントロールユニット4が、カメラ1から入力される今回の制御タイミングにおける撮像データと以前の制御タイミングにおける撮像データとを比較して、両者で一致している撮像データに基づいて雨滴量の判定を行うよう構成されていることを特徴とする。



## 【特許請求の範囲】

【請求項1】 車両のフロントウインドにおけるワイパの払拭範囲を後方から前方に向けて撮影可能に撮像手段が設けられ、

この撮像手段から入力される撮像データに基づいて雨滴を検出するコントロールユニットが設けられ、

このコントロールユニットは、撮像手段から入力される今回の制御タイミングにおける撮像データと以前の制御タイミングにおける撮像データとを比較して、両者で一致している撮像データに基づいて雨滴量の判定を行うよう構成されていることを特徴とする車両用雨滴検出装置。

【請求項2】 前記コントロールユニットは、前記一致している撮像データにおいて各画素の明暗の階調と予め設定されたしきい値との比較に基づいて白と黒のいずれかに処理する白黒化処理を実行し、白の部分を雨滴として取り扱って雨滴量の検出を行うよう構成されていることを特徴とする請求項1に記載の車両用雨滴検出装置。

【請求項3】 前記コントロールユニットは、ワイパの作動を制御するワイパ制御を実行するよう構成され、かつ、このワイパ制御において、雨滴量の検出結果に基づいてワイパの払拭タイミングである間欠時間を設定する間欠時間設定処理を実行するよう構成されていることを特徴とする請求項1または2に記載の車両用雨滴検出装置。

【請求項4】 請求項3に記載の車両用雨滴検出装置において、前記コントロールユニットは、入力手段として車両が走行中であるか否かを検出する走行検出手段が設けられ、前記間欠時間設定処理を実行するにあたり、車両が非走行中には無限大を含む最大値に間欠時間を設定し、一方、車両の走行中には、検出した雨滴量に応じて間欠時間を設定するよう構成されていることを特徴とする車両用雨滴検出装置。

【請求項5】 請求項2に記載の車両用雨滴検出装置において、前記コントロールユニットは、ワイパによる払拭が成された直後に、今回の白の部分と以前の白の部分とで一致する割合が少なくなったときに、降雨と判定し、ワイパによる払拭が成されないときに、今回の白の部分と以前の白の部分とで一致する割合が多いときに仮降雨と判定し、ワイパによる払拭直後に、今回の白の部分と以前の白の部分とで一致する割合が多い場合に非降雨と判定する降雨判定処理を実行し、さらに、ワイパの作動を制御するワイパ制御において、仮降雨判定時ならびに非降雨判定時には、ワイパの払拭タイミングである間欠時間を無限大を含む所定の最大値に設定し、降雨判定時には、白の面積に応じて間欠時間を設定する間欠時間設定処理を実行するよう構成されていることを特徴とする車両用雨滴検出装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、車両のフロントウインドに付いた雨滴を、画像入力用のCCDカメラやC-MOSセンサなどの撮像手段で撮像し、画像認識により検出する車両用雨滴検出装置に関する。

【0002】

【従来の技術】従来、CCDカメラなどの撮像手段を用いて画像入力し、フロントウインドに付いた雨滴を検出する装置が、例えば、特開平10-90188号公報や特開平10-111249号公報などにより知られている。これらの技術にあつては、外の景色やワイパと雨滴とを区別するために、特開平10-90188号の技術では、フロントウインドにおいて撮像手段の撮像エリア部分に、前方からの光（画像）を分散させて写り込みを防止する乳濁色すりガラス様の半透明フィルムを貼り付けた構成としており、また、特開平10-111249号の技術では、フロントウインドの前方のボンネットに、比較物体としてエンブレムなどを設定し、この比較物体の画像における輪郭部のぼけ状態に基づいて雨滴を検出するよう構成している。

【0003】

【発明が解決しようとする課題】しかしながら、前者の特開平10-90188号公報に記載の技術では、フロントウインドに半透明フィルムを設ける必要があるため、このフィルムが視界を妨げない位置に設置位置が限られ、設計自由度に劣るという問題を有しているとともに、高価な撮像手段が雨滴検出専用となってしまう、非経済的であるとともに汎用性に劣るという問題を有していた。すなわち、近年、自動走行制御の研究が進められており、この制御において、前走車の認識や道路の白線などの認識などに撮像手段が用いられていたり、あるいは照明の点灯・消灯の制御の入力としても撮像手段が用いられたりするが、これらの制御と兼用することが困難であり、それぞれの制御専用の撮像手段を設置すると高価になってしまうとともに、複数の撮像手段を設置するスペースがない場合にはいずれかの装置が設置できなくなり、汎用性の点で不利となる。

【0004】また、後者の特開平10-111249号公報に記載の技術では、ボンネット上に起立状態で設ける必要のある比較物体の設置が不可欠であるとともに、撮像手段もこの比較物体に向けて設置する必要があるため、この技術にあつても上記と同様に、撮像手段を他の制御の入力手段として兼用することができず用途が限られ、経済性ならびに汎用性の点で不利であり、かつ、設計自由度が低いという問題を有していた。

【0005】本発明は、上述の従来の問題点に着目して成されたもので、撮像手段の設置位置の制約ならびに撮像手段の設置方向の制約を少なくするとともに、映像の背景を取り込まないようにする部材を不要とすることで、撮像手段を他の用途にも用いることを可能とし、設計自由度の向上を図るとともに、経済性ならびに汎用性

の向上を図ることを目的としている。

【0006】

【課題を解決するための手段】上述の目的を達成するために本発明は、車両のフロントウインドにおけるワイパの払拭範囲を後方から前方に向けて撮影可能に撮像手段が設けられ、この撮像手段から入力される撮像データに基づいて雨滴を検出するコントロールユニットが設けられ、このコントロールユニットは、撮像手段から入力される今回の制御タイミングにおける撮像データと以前の制御タイミングにおける撮像データとを比較して、両者で一致している撮像データに基づいて雨滴量の判定を行うよう構成されていることを特徴とする。

【0007】なお、請求項2に記載のように、請求項1に記載の車両用雨滴検出装置において、前記コントロールユニットは、前記一致している撮像データにおいて各画素の明暗の階調と予め設定されたしきい値との比較に基づいて白と黒のいずれかに処理する白黒化処理を実行し、白の部分を雨滴として取り扱って雨滴量の検出を行うよう構成してもよい。

【0008】また、請求項3に記載のように、請求項1または2に記載の車両用雨滴検出装置において、前記コントロールユニットは、ワイパの作動を制御するワイパ制御を実行するよう構成され、かつ、このワイパ制御において、雨滴量の検出結果に基づいてワイパの払拭タイミングである間欠時間を設定する間欠時間設定処理を実行するよう構成してもよい。

【0009】また、請求項4に記載のように、請求項3に記載の車両用雨滴検出装置において、前記コントロールユニットは、入力手段として車両が走行中であるか否かを検出する走行検出手段が設けられ、前記間欠時間設定処理を実行するにあたり、車両が非走行中には無限大を含む最大値に間欠時間を設定し、一方、車両の走行中には、検出した雨滴量に応じて間欠時間を設定するよう構成してもよい。

【0010】また、請求項5に記載のように、請求項2に記載の車両用雨滴検出装置において、前記コントロールユニットは、ワイパによる払拭が成された直後に、今回の白の部分と以前の白の部分とで一致する割合が少なくなったときに、降雨と判定し、ワイパによる払拭が成されないときに、今回の白の部分と以前の白の部分とで一致する割合が多いときに仮降雨と判定し、ワイパによる払拭直後に、今回の白の部分と以前の白の部分とで一致する割合が多い場合に非降雨と判定する降雨判定処理を実行し、さらに、ワイパの作動を制御するワイパ制御において、仮降雨判定時ならびに非降雨判定時には、ワイパの払拭タイミングである間欠時間を無限大を含む所定の最大値に設定し、降雨判定時には、白の面積に応じて間欠時間を設定する間欠時間設定処理を実行するよう構成してもよい。

【0011】

【発明の作用および効果】本発明では、撮像手段は、フロントウインドのワイパの払拭範囲越しに車両前方を撮影する。そして、今回の制御タイミングにおける撮像データと、以前の制御タイミングにおける撮像データとを比較し、両者で一致している撮像データに基づいて雨滴量の判定を行う。すなわち、撮像手段は、フロントウインドならびに前方の景色を撮影しているが、車両が走行している場合、前方の景色は時々刻々と変化しているのに対して、フロントウインドは撮像手段に対して相対的に固定されている。したがって、今回の撮像データと以前の撮像データとで、一致しているデータはフロントウインドに関するデータであり、一方、不一致のデータは前方の景色と見なすことができる。さらに、降雨の場合には、フロントウインドに雨滴が付着するとともに、ワイパの払拭作動により一旦取り除かれるから、上述の一致データであるフロントウインドに関する撮像データは、フロントウインドに付着した雨滴の状態ならびに払拭状態を示すことになるものであり、この撮像データに基づいて雨滴量の判定を行うことができる。

【0012】このように、本発明では、フロントウインド越しに車両前方の景色を撮影するように撮像手段を設置していても雨滴量の判定を行うことができる。したがって、撮像手段を、自動走行制御の前方モニタや白線検知やナンバプレート認識などにおける入力手段として兼用したり、あるいはオートライト制御において明暗を判定するための入力手段として兼用したりすることができ、全体のコストダウンを図ることが可能となるとともに、装置の汎用性の向上を図ることができるという効果を奏する。加えて、撮像手段は、ワイパの払拭範囲越しに撮影できる位置に設置すればよいから、従来よりも設置位置の制約が軽くなり、設置自由度が高くなって設計自由度の向上を図ることができるという効果を奏する。

【0013】また、請求項2に記載の発明では、以前と今回とで一致している撮像データにおいて各画素の明暗の階調と予め設定されたしきい値との比較に基づいて白と黒のいずれかに処理する白黒化処理を実行し、白の部分を雨滴として取り扱って雨滴量の検出を行う。すなわち、雨滴は光るため、白成分となる。そこで、このように白黒化を行って、白の部分に基づいて雨滴量の検出を行うことにより、雨滴量を数値化して判断することが容易となる。

【0014】請求項3に記載の発明では、コントロールユニットは、雨滴量の検出結果に基づいてワイパの払拭タイミングである間欠時間を設定する間欠時間設定処理を実行する。これにより、降雨の状態に応じた最適の間欠時間でワイパを払拭作動させることができる。

【0015】請求項4に記載の発明にあつては、車両が非走行中には無限大を含む最大値に間欠時間を設定し、一方、車両の走行中には、検出した雨滴量に応じて間欠時間を設定する。したがって、車両が停車しているとき

には、前方の景色が変化しないため、景色に関するデータも今回と以前とで一致してしまい、雨滴量の判定が難しくなるが、ワイパの間欠時間を、無限大を含む最大値に設定することにより、誤作動するのを排除することができるとともに、ワイパを無駄に払拭作動させることができない。また、走行中は、ワイパの間欠時間を雨滴量に応じた最適値に設定することができる。これにより、使い勝手の向上を図ることができるという効果を奏する。

【0016】請求項5に記載の発明にあっては、今回の白の部分と以前の白の部分とを比較し、ワイパによる払拭が成された直後に、今回の白の部分と以前の白の部分とで一致する割合が少なくなったときは、雨がワイパにより払拭されたのに対応しているから、降雨と判定する。また、ワイパによる払拭が成されないときに、今回の白の部分と以前の白の部分とで一致する割合が多いときには、フロントウインドに雨が付着している可能性が高いとして仮降雨と判定する。また、ワイパによる払拭直後に、今回の白の部分と以前の白の部分とで一致する割合が多い場合には、白の部分が雨滴を示していないとして、非降雨と判定する。そして、仮降雨判定時ならびに非降雨判定時には、ワイパの払拭タイミングである間欠時間を所定の最大値に設定して払拭回数を抑え、一方、降雨判定時には、白の面積に応じて間欠時間を設定する間欠時間設定処理を実行する。以上のように、無駄なワイパによる払拭を無くすとともに、雨滴量に応じて最適の払拭作動を行うことができ、高い製品品質を得ることができる。

【0017】

【発明の実施の形態】以下に、本発明の実施の形態を図面に基いて説明する。図1は、本発明の車両用雨滴検出装置を適用した実施の形態としての車両用ワイパ装置WMの構成を示す全体図である。図において、1は撮像手段としてのCCDカメラ（以下、カメラという）であって、フロントウインド2におけるワイパ3による払拭範囲の後方位置（車室内側）に設置され、車両前方を撮影するよう設置されている。

【0018】前記カメラ1の撮像データは、コントロールユニット4に入力される。このコントロールユニット4は、カメラ1、操作スイッチ5ならびに車速検出スイッチ6からの入力に基づいて前記ワイパ3を払拭作動させるモータ7の駆動を制御するものである。なお、前記操作スイッチ5は、運転者が操作するものであって、図外のハンドルの近傍位置に設置され、ハイモード・ローモードの2種類の払拭速度を選択することができるとともに、後述する自動的に払拭速度を切り替える（間欠時間を設定する）自動モードと、ウォッシュ液を吹き付けワイパ3を数回払拭作動させてフロントウインド2を洗うウォッシュモードとを選択できるよう構成されている。また、車速検出スイッチ6は、後述する実施の形態1において必要な構成であって、車両が走行すると（実

際には、0～3km/h程度よりも高い速度となると）ONとなるスイッチである。

【0019】次に、図2に示すフローチャートに基づいてコントロールユニット4のメインフローを説明する。このメインフローは、雨滴検出以外のカメラ1からの入力に基づく制御も含むものである。まず、ステップ201において所定の初期処理を実行し、続くステップ202において、イグニッションスイッチIGNがONであるか否かを判定し、OFFの場合は、ステップ203に進んで割り込みを禁止した後、ステップ204においてスリープ処理を実行する。なお、このスリープ処理は、イグニッションスイッチIGNをONとした時点で解消される。

【0020】イグニッションスイッチIGNがONであれば、ステップ202からステップ205に進み、割り込み許可となっているか否かを判定し、割り込み許可となっていればそのままステップ200に進むが、割り込み禁止となっていればステップ206に進んで割り込み許可とする処理を実行してステップ200に進む。

【0021】ステップ200は、ワイパ制御以外の処理を実行するものであり、例えば、ステップ200aに示すように、カメラ1からの入力に基づいて前方をモニタする前方モニタ処理や、ステップ200bに示すように、カメラ1からの入力に基づいて外部の明暗を判断して照明の点灯・消灯を制御するオートライト処理や、ステップ200cに示すように、カメラ1からの入力に基づいて道路の白線を検知する白線検知処理や、ステップ200dに示すように、カメラ1からの入力に基づいて前走車のナンバープレートを認識するナンバープレート認識処理などを実行するものである。

【0022】その後、ステップ207に進んでワイパ制御を実行する。このワイパ制御に、本発明の雨滴検出装置が適用されているものであって、以下に、実施の形態別に詳細に説明する。

【0023】（実施の形態1）図3のフローチャートは、実施の形態1におけるコントロールユニット4のワイパ制御流れを示している。まず、ステップ101では、操作スイッチ5のポジションが自動モードであるか否かを判定し、自動モードの場合にはステップ102に進み、一方、自動モード以外では、ステップ111に進む。

【0024】ステップ102では、車速検出スイッチ6が走行を検出しているか否かを判定し、走行を検出している場合にはステップ103に進み、走行を検出していない場合にはステップ112に進む。なお、このステップ112では、間欠時間を最大値（例えば、20sec）に設定するもので、この最大値には、無限大も含まれており、間欠時間を無限大にすると、ワイパ3の作動を停止させることを意味するものである。

【0025】ステップ103では、撮影感度調整を実行

する。この撮影感度調整とは、カメラ1から取り込んだ画像が明る過ぎたり暗過ぎたりしないように調整するためのものであり、具体的には、全画素において例えば256階調の照度の平均値を求め、予め設定されている適切範囲（例えば70～180の範囲）に収まっているか否かに基づいて、暗過ぎれば感度を上げ、明る過ぎれば感度を下げる補正を実行する。これにより、天候の影響あるいはトンネルや方位などの影響を排除するためのものである。

【0026】ステップ104では、カメラ1で撮影した画像の取り込みを行う。続くステップ105では、エッジ強調処理を行う。このエッジ強調処理とは、雨滴の光部分を検知しやすくするために明暗を際立たせる処理であって、各画素からの入力それぞれについて、隣り合う画素との差を強調させるエッジ強調フィルタをかけることにより画像のエッジ部分を際立たせる処理を実行する。

【0027】ステップ106では、上記のようにエッジ強調処理を実行した信号をメモリする処理（この画像を $P_n$ で表す）を実行する。続くステップ107では、一致画像作成処理を実行する。この一致画像作成処理とは、前回のメモリ画像（ $P_{n-1}$ ）と今回のメモリ画像（ $P_n$ ）とを比較し、両者で一致している画像 $P_w$ を抜き出す処理である。すなわち、車両が走行しており、またワイパ3が払拭作動を行っている状態において、カメラ1から入力された画像データのうちで、前回と今回とで一致していない部分というのは、車両前方の景色ならびにワイパ3の動きと判断することができる。それに対して、前回と今回とで一致するデータというのは、カメラ1に対して変動しないフロントウインド2の表面の像であって、この表面に付着している雨滴を示していると見なすことができる。そこで、このステップ107では、一致画像（ $P_w$ ）を作成するものである。なお、この比較は、前回との比較に限定されるものではなく、前々回あるいは前々々回との比較、あるいは前回、前々回、前々々回の全てと比較することとしてもよい。

【0028】次にステップ108では、今回のメモリ画像 $P_n$ を、次回の一致画像作成処理のために $P_{n-1}$ としてメモリする処理を実行する。なお、前記比較が、前回に限らず、前々回あるいは前々々回と比較、あるいはこれら全てと比較する場合は、メモリも同様に、今回だけでなく前々回あるいは前々々回もメモリ処理する。

【0029】次にステップ109では、しきい値処理を実行する。すなわち、各画素からの入力について所定のしきい値と比較して、白か黒のいずれか一方とする処理を実行する。この場合、例えば画素が256階調のとき、150以上は全て白とし、150未満であれば全て黒とするような処理により白黒化を行う。この白黒化した数値が雨滴量を示している。すなわち、雨滴が付着している部分が反射して白として処理されるものであり、

白の画素数が雨滴量を表している。なお、白黒化処理のしきい値150は、実験によってチューニングするもので、これらの値に限定されるものではない。

【0030】ステップ110では、ワイパ間欠時間設定処理を行う。すなわち、このステップ110では、ステップ109において白黒化したデータに基づいて白の画素数 $W$ をカウントし、その白の画素数 $W$ に基づいてワイパの間欠時間を設定するもので、例えば、前記画素数 $W$ と所定の複数のしきい値とを比較することにより、複数段階設定されている作動時間（例えば、20秒間に1回～ $n$ 回作動）の中から最適の間欠時間を選択する。ちなみに、この間欠時間は、白の画素数 $W$ が大きいほど短くなるものであり、例えば、図4に示すように、間欠時間を短くする側に設定するときと長くする側に設定するときとでヒステリシスを持たせるようにするのが好ましい。

【0031】続くステップ111では、ワイパ出力処理を実行するもので、すなわちステップ110で設定された間欠時間に応じた出力、あるいはステップ112で設定された停止あるいは最大間欠時間に応じた出力、あるいは操作スイッチ5のポジションに応じてハイモード・ローモード・ウォッシュモードのいずれかに応じた出力を行う。なお、以上説明した実施の形態1において、操作スイッチ5のハイモード・ローモード・ウォッシュモードの信号は、コントロールユニット4に入力されるように構成したが、これらのモードに対応してコントロールユニット4を経由することなく直接モータ7を駆動させるよう構成してもよい。

【0032】次に、実施の形態1の車両用ワイパ装置WMの作動を説明する。本実施の形態1では、運転者が操作スイッチ5を操作すると、コントロールユニット4は、ハイモードが選択されているときにはワイパ3を高速で払拭させ、ローモードが選択されているときにはワイパ3を低速で払拭させ、ウォッシュモードが選択されているときには洗浄作動を実行させる（ステップ101→111の流れ）。

【0033】また、操作スイッチ5により自動モードが選択されているときには、以下のように作動させる。まず、コントロールユニット4は、車速検出スイッチ6が停車を検出しているときには、停止（間欠時間無限大）を含む最大間欠時間に設定する（ステップ101→102→112→111の流れ）が、車速検出スイッチ6が走行を検出しているときには、雨滴検出量に応じて間欠時間を設定する。

【0034】この雨滴検出量に応じた間欠時間の設定は、まず、カメラ1により、フロントウインド2のワイパ払拭範囲越しに車両前方を撮影し、これにより得られた撮像データに対して画像のエッジを強調するエッジ処理を行った画像 $P_n$ と、その前回の画像 $P_{n-1}$ とで一致する画像 $P_w$ を作成して、時々刻々と変化する車両前

方の景色やワイパ3の像を消去し、フロントウインド2に付着した雨滴を示す画像のみとする処理を実行する。そして、この画像Pwを白黒化し、白の画素数Wに基づいて間欠時間を設定し、この間欠時間に基づいてモータ7を駆動させる（ステップ101→102→103→104→105→106→107→108→109→110→111の流れ）。

【0035】以上説明したように、本実施の形態1では、雨滴量を検出するにあたり、今回の画像Pnと前回の画像Pn-1とで一致する部分を抽出することにより、車両前方の景色やワイパ3の画像を削除するように構成したために、従来技術のようにカメラ1により前方の景色を撮影しないようフロントウインド2に半透明のフィルムを設けたり、ボンネットにエンブレムなどの比較物体を設けこれをカメラ1で撮影したりする必要がなくなる。したがって、カメラ1を、自動走行装置の前方モニタや白線検知やナンバプレート認識などの入力手段や、オートライト制御における照明の点灯・消灯判断を行うための入力手段として兼用可能となり、コスト的に有利とすることができるとともに、汎用性の向上を図ることができるという効果が得られ、かつ、カメラ1の設置位置に対する制約が減り、設計自由度が向上するという効果が得られる。

【0036】さらに、実施の形態1にあっては、自動モードによる作動を実行する度に、撮像照度調整を実行する（ステップ103）ように構成したため、天候の変化やトンネルなどの走行条件の影響を補正して、検出精度の向上を図ることができるという効果が得られる。

【0037】また、実施の形態1にあっては、入力した画像に対して画像の縁を際立たせるエッジ処理を実行するよう構成したため、雨滴の光部分を検知し易くなり、よりいっそう検出精度の向上を図ることができる。

【0038】さらに、実施の形態1にあっては、間欠時間の設定にあたり、図4に示すように間欠時間を短くするとときと長くするときとでヒステリシスを持たせたため、入力のばらつきにより間欠時間が細かに変化することが無く、作動の安定を図ることができる。

【0039】（実施の形態2）次に、図5のフローチャートに基づき実施の形態2について説明する。実施の形態1では、車速検出スイッチ6の検出に基づき走行中か否かにより間欠時間の設定を切り替えていたが、この実施の形態2では、車速検出スイッチ6を廃止し、雨フラグのセット・リセットに基づいて間欠時間の切り替えを行うようにしている点で実施の形態1とは異なる。なお、この実施の形態2を説明するにあたり、実施の形態1と同じ処理を実行するステップでは、実施の形態1と同じ番号を付けることにより説明を省略する。

【0040】実施の形態2において、スタートからステップ108までの流れでは、ステップ102の車速検出スイッチ6の状態を判定するステップが無くなっている

点が実施の形態1と異なる。この車速検出スイッチ6に基づく判定の代わりに、ステップ108に続いてステップ300～308の雨滴判別ステップが設けられている。

【0041】まず、ステップ300では、ステップ107において形成した一致画像Pwを実施の形態1のステップ109と同様にしきい値化処理（白黒化処理）し、しきい値化処理信号Pbを形成する。

【0042】ステップ301では、このしきい値化処理信号Pbの今回値Pbと、前回値Pn-1とを比較し、白の部分の一致が90%以上であればステップ302に進む一方で、白の部分の一致が90%未満であればステップ306に進む。なお、この比較において、白の部分の一致する割合（%）は、実験によってチューニングされるもので、90%は、その一例である。また、この比較は、前回との比較に限定されるものではなく、前々回あるいは前々々回との比較、もしくはこれら全てとの比較としてもよい。

【0043】ステップ302では、ワイパ3による払拭作動を実行したか否かを判定し、払拭作動を行った場合には、フロントウインド2を払拭したのに白の一致が多いのであるから、白の画素が雨を示しているものではないと判断し、ステップ305に進んで雨フラグ=0とする。一方、ステップ302においてワイパ3による払拭作動が実行されていない場合には、白の画素が雨を示している可能性が高いと判断する。そして、ステップ303に進んで、雨フラグのセット状態を見て、雨フラグ=2であれば雨が降っているとしてステップ110に進んで間欠時間の設定を行う。一方、ステップ303において、雨フラグ=2でない場合には、雨の可能性が高いとして、まず、ステップ304に進んで雨判断の第1段階である雨フラグ=1とする処理を実行する。この雨フラグ=1は、仮の雨判断に相当するものである。

【0044】ステップ301において、白の一致が少ない場合、ステップ306に進んで、ワイパ3による払拭作動が実行されたか否かを判定し、払拭作動が成されない場合には、雨が付着していないとしてステップ305に進む。一方、ワイパ3による払拭作動が成されている場合には、雨の可能性が高いと判断する。すなわち、ワイパ3が払拭作動を行ったら雨を示す白の部分が一致しなくなったのであるから雨がワイパ3により払拭された可能性が高い。そこで、ステップ307に進んで、まず雨フラグがどのようにセットされているか判断し、雨フラグ=0である場合には、その状態を維持してステップ112に進み、間欠時間を最大にセットする。一方、雨フラグ=0でない場合、すなわち雨フラグ=1または2の場合には、雨が付着していると判断し、ステップ308に進んで雨フラグ=2にセットした後、ステップ110に進んで間欠時間の設定を行う。

【0045】以上のように、実施の形態2では、しきい



値処理を行った後のしきい値処理化信号Pbの今回値と前回値とを比較して、白の部分の一致が多いか少ないかと、その前の時点でワイパ3による払拭作動を行ったか否かとに基づいて、雨の可能性が高い順に、雨フラグ＝2（雨判断）、雨フラグ＝1（仮雨判断）、雨フラグ＝0（非雨判断）の3段階の雨の判断を行うようにし、また、この雨判断が成されないときには最大間欠作動を行うようにしたため、高い精度で雨判断を行うことができるとともに、雨ではないときに不要な払拭作動を実行することがない。

【0046】以上、図面により実施の形態について説明したが、本発明はこれに限定されるものではない。例えば、実施の形態では、カメラ1を前方モニタ、オートライト制御、白線検知、ナンバープレート認識の入力手段として兼用させる例を示したが、これらの制御と必ずしも兼用させる必要はない。

【図面の簡単な説明】

【図1】実施の形態の車両用ワイパ装置WMの構成を示

す全体図である。

【図2】実施の形態のメインフローを示すフローチャートである。

【図3】実施の形態1の雨滴検出を含むワイパ制御を示すフローチャートである。

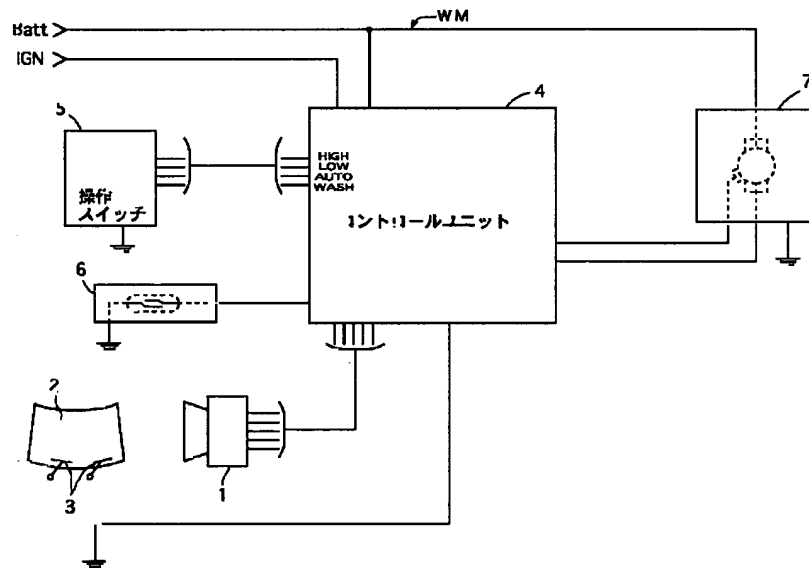
【図4】実施の形態1の間欠時間特性図である。

【図5】実施の形態2の雨滴検出を含むワイパ制御を示すフローチャートである。

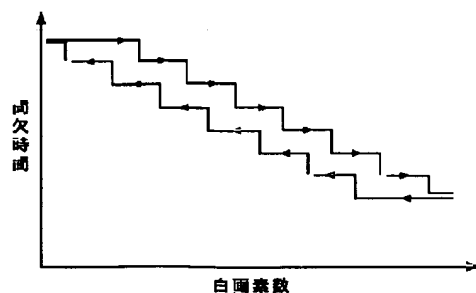
【符号の説明】

- 1 CCDカメラ
  - 2 フロントウインド
  - 3 ワイパ
  - 4 コントロールユニット
  - 5 操作スイッチ
  - 6 車速検出スイッチ
  - 7 モータ
- WM 車両用ワイパ装置

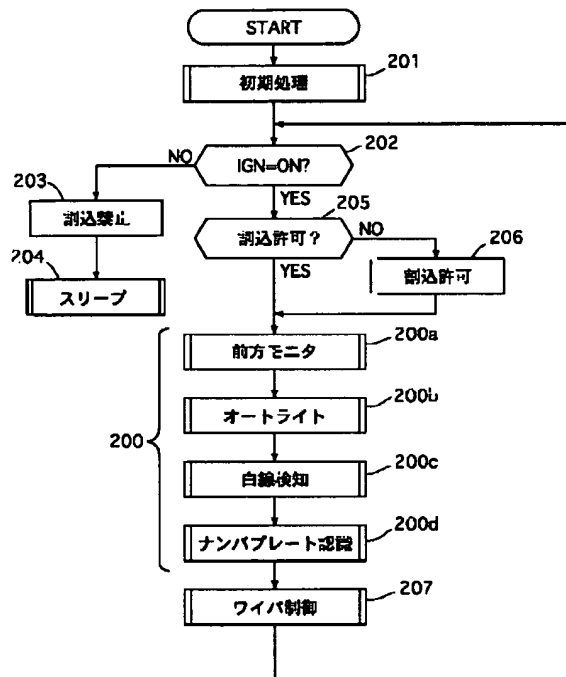
【図1】



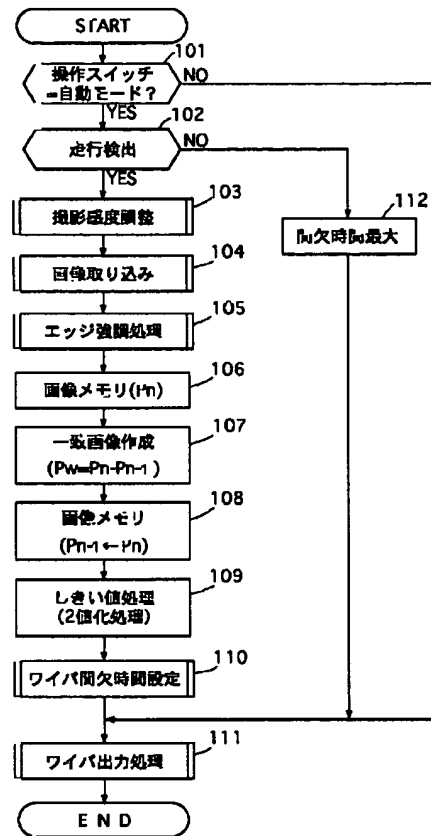
【図4】



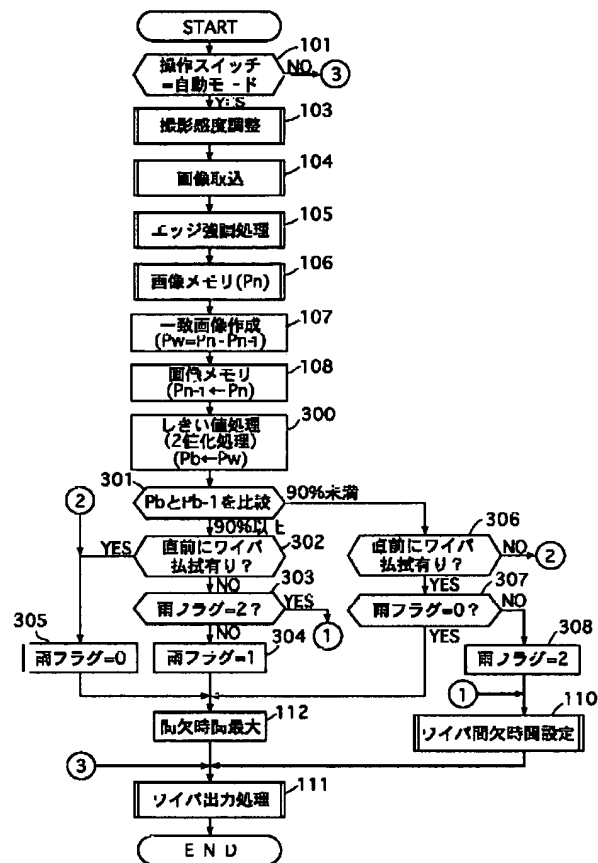
【図2】



【図3】



【図5】



フロントページの続き

Fターム(参考) 2G059 AA05 BB04 CC11 FF01 HH02  
 KK04 MM05 MM09 MM10 MM20  
 3D025 AA01 AC01 AD02 AG16 AG28  
 AG42

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CLAIMS

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[Claim(s)]

[Claim 1] Turn the eradication range of the wiper in the front window of a car ahead from back, and an image pick-up means is established possible [ photography ]. The control unit which detects a raindrop based on the image pick-up data inputted from this image pick-up means is prepared. This control unit Raindrop detection equipment for cars characterized by comparing with the image pick-up data in former control timing the image pick-up data in this control timing inputted from an image pick-up means, and being constituted so that the amount of raindrops may be judged based on the image pick-up data which are in agreement in both.

[Claim 2] Said control unit be raindrop detection equipment for cars according to claim 1 characterize by be constitute so that black and white-ized processing process to white or black based on the comparison with the gradation of the light and darkness of each pixel and the threshold set up beforehand in said congruous image pick-up data may be perform, a white part may be deal with as a raindrop and the amount of raindrops may be detect.

[Claim 3] Said control unit is raindrop detection equipment for cars according to claim 1 or 2 characterized by being constituted so that intermittent time setting processing in which are constituted so that wiper control which controls actuation of a wiper may be performed, and the intermittent time amount which is the eradication timing of a wiper is set up in this wiper control based on the detection result of the amount of raindrops may be performed.

[Claim 4] In the raindrop detection equipment for cars according to claim 3 said control unit A transit detection means to detect whether a car is running as an input means is established. Raindrop detection equipment for cars characterized by being constituted so that in performing said intermittent time setting processing intermittent time amount may be set as the maximum to which a car contains infinity during un-running and intermittent time amount may be set up during transit of a car on the other hand according to the detected amount of raindrops.

[Claim 5] In the raindrop detection equipment for cars according to claim 2 said control unit When the rate that it is in agreement in the part of this white and the part of former white immediately after the eradication by the wiper accomplished decreases When there are many rates that it is in agreement in the part of this white and the part of former white when it judges with a rainfall and eradication by the wiper does not accomplish, it judges with a temporary rainfall. In the wiper control which performs rainfall judging processing judged to be a non-rainfall when there are many rates that it is in agreement in the part of this white and the part of former white, and controls actuation of a wiper further immediately after eradication by the wiper Raindrop detection equipment for cars which sets the intermittent time amount which is the eradication timing of a wiper as the predetermined maximum containing infinity, and is characterized by being constituted so that intermittent time setting processing in which intermittent time amount is set up according to a white area may be performed at the time of a rainfall judging at the time of a temporary rainfall judging and a non-rainfall judging.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention picturizes the raindrop attached to the front window of a car with image pick-up means, such as a CCD camera, a C-MOS sensor, etc. for an image input, and relates to the raindrop detection equipment for cars detected according to image recognition.

[0002]

[Description of the Prior Art] Conventionally, an image input is carried out using image pick-up means, such as a CCD camera, and the equipment which detects the raindrop attached to the front window is known by JP,10-90188,A, JP,10-111249,A, etc. If it is in these techniques, in order to distinguish a scene, an outer wiper, and an outer raindrop, with the technique of JP,10-90188,A It is considering as the configuration which stuck the translucent film of the cloudy-milky-color ground glass who the image pick-up area part of an image pick-up means is made to distribute the light (image) from the front in a front window, and prevents a reflect lump. Moreover, an emblem etc. is set as the bonnet ahead of a front window as a comparison body, and it constitutes from a technique of JP,10-111249,A so that a raindrop may be detected based on the dotage condition of the profile section in the image of this comparison body.

[0003]

[Problem(s) to be Solved by the Invention] However, since it was necessary to prepare a translucent film in a front window with a technique given in former JP,10-90188,A, the installation location was restricted to the location where this film does not bar a field of view, while having the problem of being inferior to a design degree of freedom, the expensive image pick-up means became only for raindrop detection, and while it was noneconomic, it had the problem of being inferior to versatility. Namely, although research of automatic transit control is advanced, the image pick-up means is used for recognition of recognition of the car in front, the white line of a road, etc. or an image pick-up means is used for it in this control in recent years also as an input of control of lighting and putting out lights of lighting If it is difficult to use also [ control / these ] and it installs the image pick-up means only for each control, while becoming expensive, when there is no tooth space in which two or more image pick-up means are installed, it becomes impossible to install one of equipments, and becomes disadvantageous in respect of versatility.

[0004] moreover, with the technique of a publication, to latter JP,10-111249,A While installation of a comparison body with the need of preparing in the state of standing up on a bonnet is indispensable Since it was necessary to also install an image pick-up means towards this comparison body, even if it was in this technique, like the above, it could not be made to serve a double purpose as an input means of other control of an image pick-up means, but the application was restricted, and it had disadvantageously the problem that a design degree of

freedom was low, in respect of economical efficiency and versatility.

[0005] This invention is making unnecessary the member it is made not incorporate the background of an image, while accomplishing paying attention to the above-mentioned conventional trouble and lessening constraint of the installation location of an image pick-up means, and constraint of the installation direction of an image pick-up means, and while making it possible to use an image pick-up means for other applications and planning improvement in a design degree of freedom, it aims at planning improvement in economical efficiency and versatility.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention turns the eradication range of the wiper in the front window of a car ahead from back, and an image pick-up means is established possible [ photography ]. The control unit which detects a raindrop based on the image pick-up data inputted from this image pick-up means is prepared. This control unit It is characterized by comparing with the image pick-up data in former control timing the image pick-up data in this control timing inputted from an image pick-up means, and being constituted so that the amount of raindrops may be judged based on the image pick-up data which are in agreement in both.

[0007] It sets to the raindrop detection equipment for cars according to claim 1 like the publication to claim 2. In addition, said control unit Black-and-white-ized processing processed to white or black based on the comparison with the gradation of the light and darkness of each pixel and the threshold set up beforehand in said congruous image pick-up data may be performed, and you may constitute so that a white part may be dealt with as a raindrop and the amount of raindrops may be detected.

[0008] Moreover, you may constitute so that intermittent time setting processing in which are constituted so that wiper control according to claim 3 by which said control unit controls actuation of a wiper like in the raindrop detection equipment for cars according to claim 1 or 2 may be performed, and the intermittent time amount which is the eradication timing of a wiper is set up in this wiper control based on the detection result of the amount of raindrops may be performed.

[0009] It sets to the raindrop detection equipment for cars according to claim 3 like the publication to claim 4. Moreover, said control unit A transit detection means to detect whether a car is running as an input means is established. In performing said intermittent time setting processing, you may constitute so that intermittent time amount may be set as the maximum to which a car contains infinity during un-running and intermittent time amount may be set up during transit of a car on the other hand according to the detected amount of raindrops.

[0010] It sets to the raindrop detection equipment for cars according to claim 2 like the publication to claim 5. Moreover, said control unit When the rate that it is in agreement in the part of this white and the part of former white immediately after the eradication by the wiper accomplished decreases When there are many rates that it is in agreement in the part of this white and the part of former white when it judges with a rainfall and eradication by the wiper does not accomplish, it judges with a temporary rainfall. In the wiper control which performs rainfall judging processing judged to be a non-rainfall when there are many rates that it is in agreement in the part of this white and the part of former white, and controls actuation of a wiper further immediately after eradication by the wiper At the time of a temporary rainfall judging and a non-rainfall judging, the intermittent time amount which is the eradication timing of a wiper may be set as the predetermined maximum containing infinity, and at the time of a rainfall judging, you may constitute so that intermittent time setting processing in which intermittent time amount is set up according to a white area may be performed.

[0011]

[Function and Effect of the Invention] In this invention, an image pick-up means photos the car

front over the eradication range of the wiper of a front window. And the image pick-up data in this control timing are compared with the image pick-up data in former control timing, and the amount of raindrops is judged based on the image pick-up data which are in agreement in both. That is, although the image pick-up means is photoing the scene of a front window and the front, when the car is running, the front window is being relatively fixed to the image pick-up means to the front scene changing every moment. Therefore, by these image pick-up data and former image pick-up data, congruous data are data about a front window, and, on the other hand, it can be considered that the data of an inequality are a front scene. Furthermore, while a raindrop adheres to a front window, once it is removed by eradication actuation of a wiper, in the case of a rainfall, the image pick-up data about the front window which is above-mentioned coincidence data can show the condition and eradication condition of a raindrop of having adhered to the front window, and can judge the amount of raindrops to it based on this image pick-up data.

[0012] Thus, in this invention, even if it is installing the image pick-up means so that the scene ahead of a car may be photoed over a front window, the amount of raindrops can be judged. Therefore, an image pick-up means can be made to serve a double purpose as an input means in a front monitor, white line detection, number plate recognition, etc. of automatic transit control, or it can be made to serve a double purpose as an input means for judging light and darkness in automatic writing control, and while becoming possible to aim at the whole cost cut, the effectiveness that improvement in the versatility of equipment can be aimed at is done so. In addition, in order for what is necessary to be just to install an image pick-up means in the location which can be photoed over the eradication range of a wiper, it does so the effectiveness that constraint of an installation location can become light conventionally, an installation degree of freedom can become high, and improvement in a design degree of freedom can be aimed at.

[0013] Moreover, in invention according to claim 2, black-and-white-ized processing processed to white or black based on the comparison with the gradation of the light and darkness of each pixel and the threshold set up beforehand in the image pick-up data which are in agreement in before and this time is performed, a white part is dealt with as a raindrop, and the amount of raindrops is detected. That is, since a raindrop shines, it serves as a white component. Then, it becomes easy by performing black-and-white-ization in this way and detecting the amount of raindrops based on a white part to evaluate and judge the amount of raindrops.

[0014] In invention according to claim 3, a control unit performs intermittent time setting processing in which the intermittent time amount which is the eradication timing of a wiper is set up based on the detection result of the amount of raindrops. Thereby, eradication actuation of the wiper can be carried out by the optimal intermittent time amount according to the condition of a rainfall.

[0015] If it is in invention according to claim 4, intermittent time amount is set as the maximum to which a car contains infinity during un-running, and, on the other hand, intermittent time amount is set up during transit of a car according to the detected amount of raindrops. Therefore, when the car has stopped, since a front scene does not change, the data about a scene are also before [ this time and ] in agreement, the judgment of the amount of raindrops becomes difficult, but while being able to eliminate incorrect-operating by setting the intermittent time amount of a wiper as the maximum containing infinity, eradication actuation of the wiper is not carried out vainly. Moreover, the intermittent time amount of a wiper can be set as the optimum value according to the amount of raindrops during transit. This does so the effectiveness that improvement in user-friendliness can be aimed at.

[0016] Since it supports that rain was wiped away by the wiper when the rate that it is in agreement in the part of this white and the part of former white immediately after it compared the part of this white with the part of former white and the eradication by the wiper



accomplished, if it was in invention according to claim 5 decreases, it judges with a rainfall. Moreover, when there are many rates that it is in agreement in the part of this white and the part of former white when eradication by the wiper does not accomplish, it judges with a temporary rainfall noting that possibility that rain has adhered to the front window is high. Moreover, it judges with a non-rainfall noting that the white part does not show the raindrop, when there are many rates that it is in agreement in the part of this white and the part of former white, immediately after eradication by the wiper. And at the time of a temporary rainfall judging and a non-rainfall judging, the intermittent time amount which is the eradication timing of a wiper is set as predetermined maximum, the count of eradication is stopped, and, on the other hand, intermittent time setting processing in which intermittent time amount is set up according to a white area is performed at the time of a rainfall judging. As mentioned above, while losing eradication by the useless wiper, optimal eradication actuation can be performed according to the amount of raindrops, and high product quality can be acquired.

[0017]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 is the general drawing showing the configuration of the wiper equipment WM for cars as a gestalt of the operation which applied the raindrop detection equipment for cars of this invention. In drawing, 1 is a CCD camera (henceforth a camera) as an image pick-up means, it is installed in the back location (vehicle interior-of-a-room side) of the eradication range by the wiper 3 in the front window 2, and it is installed so that the car front may be photoed.

[0018] The image pick-up data of said camera 1 are inputted into a control unit 4. This control unit 4 controls the drive of a motor 7 which carries out eradication actuation of said wiper 3 based on the input from a camera 1, the actuation switch 5, and the vehicle speed pilot switch 6. In addition, said actuation switch 5 be constitute so that the automatic mode which be mention later and which change an eradication rate automatically ( intermittent time amount be set up), and the wash mode in\_which spray washer liquid, carry out eradication actuation of the wiper 3 several times, and the front window 2 be wash may be choose, while an operator operate it, be install in the near location of the handle outside drawing and being able to choose two kinds of eradication rates of a high mode raw mode. Moreover, it is a required configuration in the gestalt 1 of operation mentioned later, and when a car runs in the vehicle speed pilot switch 6, it is a switch used as ON (when it becomes a rate higher than 0 - 3 km/h extent in fact).

[0019] Next, the Maine flow of a control unit 4 is explained based on the flow chart shown in drawing 2 . This Maine flow also includes the control based on the input from cameras 1 other than raindrop detection. First, predetermined initial processing is performed in step 201, and in continuing step 202, it judges whether an ignition switch IGN is ON, and in OFF, after progressing to step 203 and forbidding interruption, sleep processing is performed in step 204. In addition, this sleep processing is canceled when an ignition switch IGN is set to ON.

[0020] If it will progress to step 205 from step 202, and it will judge whether it is interruption authorization, if an ignition switch IGN is ON, and it has become interruption authorization, it will progress to step 200 as it is, but if it is the ban on interruption, the processing which progresses to step 206 and is considered as interruption authorization will be performed, and it will progress to step 200.

[0021] As step 200 performs processings other than wiper control and shows them to step 200a As shown in the front monitor processing which carries out the monitor of the front based on the input from a camera 1, and step 200b As shown in the automatic writing processing which judges external light and darkness based on the input from a camera 1, and controls lighting and putting out lights of lighting, and step 200c White line detection processing which detects the white line of a road based on the input from a camera 1, number plate recognition

processing in which the number plate of the car in front is recognized based on the input from a camera 1 as shown in step 200d, etc. are performed.

[0022] Then, it progresses to step 207 and wiper control is performed. The raindrop detection equipment of this invention is applied to this wiper control, and it explains in a detail according to the gestalt of operation below.

[0023] (Gestalt 1 of operation) The flow chart of drawing 3 shows the wiper control flow of the control unit 4 in the gestalt 1 of operation. First, at step 101, it judges whether the position of the actuation switch 5 is automatic mode, in the case of automatic mode, progresses at step 102, and, on the other hand, progresses to step 111 except automatic mode.

[0024] At step 102, it judges whether the vehicle speed pilot switch 6 has detected transit, when transit is detected, it progresses to step 103, and when transit is not detected, it progresses to step 112. In addition, at this step 112, intermittent time amount is set as maximum (for example, 20sec), infinity is also contained in this maximum, and it means stopping actuation of a wiper 3 as making intermittent time amount into infinity.

[0025] Photography sensitivity settling is performed at step 103. This photography sensitivity settling has the too bright image captured from the camera 1, or the average of the illuminance of 256 gradation is calculated [ in / specifically / are for adjusting so that too darkly, and / all pixels ], based on whether it has fitted in the suitable range (for example, the range of 70-180) set up beforehand, if too dark, sensibility will be raised, and if too bright, amendment which lowers sensibility will be performed. Thereby, it is a thing in order to eliminate the effect of the weather, or the effect of a tunnel, bearing, etc.

[0026] The image photoed with the camera 1 is captured at step 104. Edge enhancement processing is performed at continuing step 105. This edge enhancement processing is processing which makes light and darkness conspicuous, in order to make the optical part of a raindrop easy to detect, and processing which makes the edge part of an image conspicuous is performed by covering the edge enhancement filter which makes a difference with the pixel which adjoins each other about each of the input from each pixel emphasize.

[0027] At step 106, processing (this image is expressed with  $P_n$ ) which carries out memory of the signal which performed edge enhancement processing as mentioned above is performed. Coincidence image creation processing is performed at continuing step 107. This coincidence image creation processing is processing which extracts the image  $P_w$  which compares the last memory image ( $P_{n-1}$ ) with this memory image ( $P_n$ ), and is in agreement in both. That is, in the condition that the car is running and the wiper 3 is performing eradication actuation, the parts which are not in agreement in last time and this time among the image data inputted from the camera 1 can be judged to be a scene ahead of a car, and a motion of a wiper 3. To it, the data which are in agreement in last time and this time are the image of the front face of the front window 2 which is not changed to a camera 1, and it can be considered that the raindrop adhering to this front face is shown. So, a coincidence image ( $P_w$ ) is created at this step 107. In addition, this comparison is good also as not being limited to the comparison with last time and comparing with all the beforehand \*\*\*\* the comparison with second-from-last-time or beforehand \*\*\*\* or last time, and second from last time.

[0028] Next, at step 108, processing which carries out memory of this memory image  $P_n$  as  $P_{n-1}$  for next coincidence image creation processing is performed. In addition, when said comparison compares with not only last time but second-from-last-time or beforehand \*\*\*\*, a comparison, or these [ all ], it carries out memory processing not only of this time but the second-from-last-time or beforehand \*\*\*\* for memory similarly.

[0029] Next, threshold processing is performed at step 109. That is, processing made into white or black about the input from each pixel as compared with a predetermined threshold is performed. In this case, when a pixel is 256 gradation, it all or more of 150 considers as white, and with 150 [ less than ], processing which is altogether made into black performs black-and-

white-ization. This black-and-white-ized numeric value shows the amount of raindrops. That is, the part to which the raindrop has adhered reflects, it is processed as white, and the white number of pixels expresses the amount of raindrops. In addition, the threshold 150 of black-and-white-ized processing is not tuned up by experiment, and is not limited to these values.

[0030] Wiper intermittent time setting processing is performed at step 110. Namely, it is what counts the white number W of pixels at this step 110 based on the data black-and-white-ized in step 109, and sets up the intermittent time amount of a wiper based on the number W of pixels of that white. For example, the optimal intermittent time amount is chosen out of the operating time (it operates once to n times in 20 seconds) set up two or more steps by comparing said number W of pixels and two or more predetermined thresholds. It is desirable to give a hysteresis in the time of setting to the side made as long incidentally as the time of setting to the side which shortens intermittent time amount as this intermittent time amount becomes so short that the white number W of pixels is large and it is shown in drawing 4.

[0031] At continuing step 111, wiper output processing is performed and the output according to either of the high mode raw mode wash modes is performed according to the position of the output according to the intermittent time amount set up at step 110, a halt set up at step 112, the output according to the maximum intermittent time amount, or the actuation switch 5. In addition, in the gestalt 1 of the operation explained above, it constituted so that it might be inputted into a control unit 4, but without going via a control unit 4 corresponding to these modes, the signal in the high mode raw mode wash mode of the actuation switch 5 may be constituted so that the direct motor 7 may be made to drive.

[0032] Next, actuation of the wiper equipment WM for cars of the gestalt 1 of operation is explained. With the gestalt 1 of this operation, if an operator operates the actuation switch 5, a control unit 4 makes a wiper 3 wipe away at high speed, when high mode is chosen, when the raw mode is chosen, it makes a wiper 3 wipe away at a low speed, and when wash mode is chosen, it will perform washing actuation (flow of step 101->111).

[0033] Moreover, when automatic mode is chosen by the actuation switch 5, it is made to operate as follows. first, the maximum intermittent time amount which includes a halt (intermittent time amount infinity) when, as for a control unit 4, the vehicle speed pilot switch 6 has detected the stop -- setting up (flow of step 101->102->112->111) -- when the vehicle speed pilot switch 6 has detected transit, intermittent time amount is set up according to the amount of raindrop detection.

[0034] First a setup of the intermittent time amount according to this amount of raindrop detection with a camera 1 The image Pn which performed edge processing which emphasizes the edge of an image to the image pick-up data which photoed the car front over the wiper eradication range of the front window 2, and were obtained by this, The image Pw which is in agreement by the image Pn-1 [ last ] is created, the scene ahead of a car and the image of a wiper 3 which change every moment are eliminated, and processing used only as the image in which the raindrop adhering to the front window 2 is shown is performed. And this image Pw is black-and-white-ized, intermittent time amount is set up based on the white number W of pixels, and a motor 7 is made to drive based on this intermittent time amount (flow of step 101->102->103->104->105->106->107->108->109->110->111).

[0035] Since it constituted from a gestalt 1 of this operation in detecting the amount of raindrops so that the scene ahead of a car and the image of a wiper 3 might be deleted by extracting the part which is in agreement by this image Pn and image Pn-1 [ last ] as explained above The need of preparing a translucent film in the front window 2, or preparing comparison bodies, such as an emblem, in a bonnet and photoing this with a camera 1 so that a front scene may not be photoed with a camera 1 like the conventional technique is lost. A camera 1 Therefore, input means, such as a front monitor of an automatic traveller, white line detection, and number plate recognition, While combination becomes possible as an input means for

making a lighting / putting-out-lights judgment of the lighting in automatic writing control and it is advantageous in cost. The effectiveness that improvement in versatility can be aimed at is acquired, and the constraint to the installation location of a camera 1 decreases, and the effectiveness that a design degree of freedom improves is acquired.

[0036] Furthermore, since [ which performs image pick-up dimmer control whenever it performs actuation by automatic mode, if it is in the gestalt 1 of operation ] it constituted like (step 103), the effect of transit conditions, such as change of the weather and a tunnel, is amended, and the effectiveness that improvement in detection precision can be aimed at is acquired.

[0037] Moreover, since it constituted so that edge processing which makes the edge of an image conspicuous to the inputted image might be performed if it was in the gestalt 1 of operation, it becomes easy to detect the optical part of a raindrop, and improvement in detection precision can be aimed at further.

[0038] Furthermore, since the hysteresis was given in the setup of intermittent time amount in the time of lengthening with the time of shortening intermittent time amount as shown in drawing 4 if it was in the gestalt 1 of operation, intermittent time amount cannot change with dispersion in an input finely, and stability of actuation can be aimed at.

[0039] (Gestalt 2 of operation) Next, the gestalt 2 of operation is explained based on the flow chart of drawing 5. Although a setup of intermittent time amount was changed by whether it is under [ transit ] \*\*\*\*\* with the gestalt 1 of operation based on detection of the vehicle speed pilot switch 6, with the gestalt 2 of this operation, the vehicle speed pilot switch 6 is abolished and it differs in the gestalt 1 of operation in that it is made to change intermittent time amount based on the set-reset of a rain flag. In addition, in explaining the gestalt 2 of this operation, at the step which performs the same processing as the gestalt 1 of operation, explanation is omitted by attaching the same number as the gestalt 1 of operation.

[0040] In the gestalt 2 of operation, it differs from the gestalt 1 of operation by the flow from a start to step 108 in that the step which judges the condition of the vehicle speed pilot switch 6 of step 102 is lost. Instead of the judgment based on this vehicle speed pilot switch 6, the raindrop distinction step of steps 300-308 is prepared following step 108.

[0041] First, at step 300, threshold-ized processing (black-and-white-ized processing) is carried out like step 109 of the gestalt 1 of operation of the coincidence image Pw formed in step 107, and the threshold-ized processing signal Pb is formed.

[0042] At step 301, if coincidence of a white part is 90% or more, while comparing this time value Pb of this threshold-ized processing signal Pb with last value Pn-1, and progressing to step 302, if coincidence of a white part is less than 90%, it will progress to step 306. In addition, in this comparison, the rate (%) whose white part corresponds is tuned up by experiment, and 90% is that example. Moreover, this comparison is not limited to the comparison with last time, and is good also as all the comparison with second-from-last-time or beforehand \*\*\*\*, or a comparison with these.

[0043] Since having wiped away the front window 2 has much coincidence of white when it judges whether eradication actuation by the wiper 3 was performed at step 302 and eradication actuation is performed, a white pixel judges that it is not what shows rain, progresses to step 305, and sets to rain flag =0. On the other hand, when eradication actuation by the wiper 3 is not performed in step 302, a white pixel judges that the possibility which shows rain is high. And it progresses to step 110 and intermittent time amount is set up noting that it progresses to step 303 and it sees the set condition of a rain flag, and it is raining, if it is rain flag =2. The rain flag which it progresses to step 304 and is the 1st step of rain decision first on the other hand noting that rain possibility is high in step 303, when it is not rain flag =2 = processing set to 1 is performed. This rain flag = 1 is equivalent to temporary rain decision.

[0044] In step 301, when it judges whether it progressed to step 306 when there was little

coincidence of white, and eradication actuation by the wiper 3 was performed and eradication actuation does not accomplish it, it progresses to step 305 noting that rain has not adhered. On the other hand, when the eradication actuation by the wiper 3 has accomplished, it is judged that rain possibility is high. That is, since the part of the white which shows rain stopped being in agreement when the wiper 3 performed eradication actuation, possibility that rain was wiped away by the wiper 3 is high. Then, it progresses to step 307 and judges how the rain flag is set first, and in being rain flag =0, the condition is maintained, and it progresses to step 112, and sets intermittent time amount to max. A rain flag when it is not rain flag =0 on the other hand = in the case of 1 or 2, after judging that rain has adhered, progressing to step 308 and setting to rain flag =2, it progresses to step 110 and intermittent time amount is set up. [0045] As mentioned above, the gestalt 2 of operation compares a value this time value of the threshold processing-ized signal Pb after performing threshold processing, and last time. It is based [ whether there to be or much coincidence of a white part is few, and ] on whether eradication actuation by the wiper 3 was performed at the previous time. When it is made to judge the rain of the three-stage of rain flag =2 (rain decision), rain flag =1 (\*\*\*\* decision), and rain flag =0 (non-rain decision) in order with high rain possibility and this rain decision does not accomplish in it, in order to perform the maximum intermittent working, While being able to make a rain judgment in a high precision, when not raining, unnecessary eradication actuation is not performed.

[0046] As mentioned above, although the drawing explained the gestalt of operation, this invention is not limited to this. For example, although the gestalt of operation showed the example make a camera 1 use also [ example ] as an input means of a front monitor, automatic writing control, white line detection, and number plate recognition, it is not necessary to make it not necessarily use also [ control / these ].

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention] This invention picturizes the raindrop attached to the front window of a car with image pick-up means, such as a CCD camera, a C-MOS sensor, etc. for an image input, and relates to the raindrop detection equipment for cars detected according to image recognition.

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**PRIOR ART**

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[Description of the Prior Art] Conventionally, an image input is carried out using image pick-up means, such as a CCD camera, and the equipment which detects the raindrop attached to the front window is known by JP,10-90188,A, JP,10-111249,A, etc. If it is in these techniques, in order to distinguish a scene, an outer wiper, and an outer raindrop, with the technique of JP,10-90188,A It is considering as the configuration which stuck the translucent film of the cloudy-milky-color ground glass who the image pick-up area part of an image pick-up means is made to distribute the light (image) from the front in a front window, and prevents a reflect lump. Moreover, an emblem etc. is set as the bonnet ahead of a front window as a comparison body, and it constitutes from a technique of JP,10-111249,A so that a raindrop may be detected based on the dotage condition of the profile section in the image of this comparison body.

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## EFFECT OF THE INVENTION

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[Function and Effect of the Invention] In this invention, an image pick-up means photos the car front over the eradication range of the wiper of a front window. And the image pick-up data in this control timing are compared with the image pick-up data in former control timing, and the amount of raindrops is judged based on the image pick-up data which are in agreement in both. That is, although the image pick-up means is photoing the scene of a front window and the front, when the car is running, the front window is being relatively fixed to the image pick-up means to the front scene changing every moment. Therefore, by these image pick-up data and former image pick-up data, congruous data are data about a front window, and, on the other hand, it can be considered that the data of an inequality are a front scene. Furthermore, while a raindrop adheres to a front window, once it is removed by eradication actuation of a wiper, in the case of a rainfall, the image pick-up data about the front window which is above-mentioned coincidence data can show the condition and eradication condition of a raindrop of having adhered to the front window, and can judge the amount of raindrops to it based on this image pick-up data.

[0012] Thus, in this invention, even if it is installing the image pick-up means so that the scene ahead of a car may be photoed over a front window, the amount of raindrops can be judged. Therefore, an image pick-up means can be made to serve a double purpose as an input means in a front monitor, white line detection, number plate recognition, etc. of automatic transit control, or it can be made to serve a double purpose as an input means for judging light and darkness in automatic writing control, and while becoming possible to aim at the whole cost cut, the effectiveness that improvement in the versatility of equipment can be aimed at is done so. In addition, in order for what is necessary to be just to install an image pick-up means in the location which can be photoed over the eradication range of a wiper, it does so the effectiveness that constraint of an installation location can become light conventionally, an installation degree of freedom can become high, and improvement in a design degree of freedom can be aimed at.

[0013] Moreover, in invention according to claim 2, black-and-white-ized processing processed to white or black based on the comparison with the gradation of the light and darkness of each pixel and the threshold set up beforehand in the image pick-up data which are in agreement in before and this time is performed, a white part is dealt with as a raindrop, and the amount of raindrops is detected. That is, since a raindrop shines, it serves as a white component. Then, it becomes easy by performing black-and-white-ization in this way and detecting the amount of raindrops based on a white part to evaluate and judge the amount of raindrops.

[0014] In invention according to claim 3, a control unit performs intermittent time setting processing in which the intermittent time amount which is the eradication timing of a wiper is set up based on the detection result of the amount of raindrops. Thereby, eradication actuation of the wiper can be carried out by the optimal intermittent time amount according to the condition of a rainfall.



[0015] If it is in invention according to claim 4, intermittent time amount is set as the maximum to which a car contains infinity during un-running, and, on the other hand, intermittent time amount is set up during transit of a car according to the detected amount of raindrops. Therefore, when the car has stopped, since a front scene does not change, the data about a scene are also before [ this time and ] in agreement, the judgment of the amount of raindrops becomes difficult, but while being able to eliminate incorrect-operating by setting the intermittent time amount of a wiper as the maximum containing infinity, eradication actuation of the wiper is not carried out vainly. Moreover, the intermittent time amount of a wiper can be set as the optimum value according to the amount of raindrops during transit. This does so the effectiveness that improvement in user-friendliness can be aimed at.

[0016] Since it supports that rain was wiped away by the wiper when the rate that it is in agreement in the part of this white and the part of former white immediately after it compared the part of this white with the part of former white and the eradication by the wiper accomplished, if it was in invention according to claim 5 decreases, it judges with a rainfall. Moreover, when there are many rates that it is in agreement in the part of this white and the part of former white when eradication by the wiper does not accomplish, it judges with a temporary rainfall noting that possibility that rain has adhered to the front window is high. Moreover, it judges with a non-rainfall noting that the white part does not show the raindrop, when there are many rates that it is in agreement in the part of this white and the part of former white, immediately after eradication by the wiper. And at the time of a temporary rainfall judging and a non-rainfall judging, the intermittent time amount which is the eradication timing of a wiper is set as predetermined maximum, the count of eradication is stopped, and, on the other hand, intermittent time setting processing in which intermittent time amount is set up according to a white area is performed at the time of a rainfall judging. As mentioned above, while losing eradication by the useless wiper, optimal eradication actuation can be performed according to the amount of raindrops, and high product quality can be acquired.

[0017]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained based on a drawing. Drawing 1 is the general drawing showing the configuration of the wiper equipment WM for cars as a gestalt of the operation which applied the raindrop detection equipment for cars of this invention. In drawing, 1 is a CCD camera (henceforth a camera) as an image pick-up means, it is installed in the back location (vehicle interior-of-a-room side) of the eradication range by the wiper 3 in the front window 2, and it is installed so that the car front may be photoed.

[0018] The image pick-up data of said camera 1 are inputted into a control unit 4. This control unit 4 controls the drive of a motor 7 which carries out eradication actuation of said wiper 3 based on the input from a camera 1, the actuation switch 5, and the vehicle speed pilot switch 6. In addition, said actuation switch 5 be constitute so that the automatic mode which be mention later and which change an eradication rate automatically ( intermittent time amount be set up), and the wash mode in\_which spray washer liquid, carry out eradication actuation of the wiper 3 several times, and the front window 2 be wash may be choose, while an operator operate it, be install in the near location of the handle outside drawing and being able to choose two kinds of eradication rates of a high mode raw mode. Moreover, it is a required configuration in the gestalt 1 of operation mentioned later, and when a car runs in the vehicle speed pilot switch 6, it is a switch used as ON (when it becomes a rate higher than 0 - 3 km/h extent in fact).

[0019] Next, the Maine flow of a control unit 4 is explained based on the flow chart shown in drawing 2 . This Maine flow also includes the control based on the input from cameras 1 other than raindrop detection. First, predetermined initial processing is performed in step 201, and in continuing step 202, it judges whether an ignition switch IGN is ON, and in OFF, after

progressing to step 203 and forbidding interruption, sleep processing is performed in step 204. In addition, this sleep processing is canceled when an ignition switch IGN is set to ON.

[0020] If it will progress to step 205 from step 202, and it will judge whether it is interruption authorization, if an ignition switch IGN is ON, and it has become interruption authorization, it will progress to step 200 as it is, but if it is the ban on interruption, the processing which progresses to step 206 and is considered as interruption authorization will be performed, and it will progress to step 200.

[0021] As step 200 performs processings other than wiper control and shows them to step 200a As shown in the front monitor processing which carries out the monitor of the front based on the input from a camera 1, and step 200b As shown in the automatic writing processing which judges external light and darkness based on the input from a camera 1, and controls lighting and putting out lights of lighting, and step 200c White line detection processing which detects the white line of a road based on the input from a camera 1, number plate recognition processing in which the number plate of the car in front is recognized based on the input from a camera 1 as shown in step 200d, etc. are performed.

[0022] Then, it progresses to step 207 and wiper control is performed. The raindrop detection equipment of this invention is applied to this wiper control, and it explains in a detail according to the gestalt of operation below.

[0023] (Gestalt 1 of operation) The flow chart of drawing 3 shows the wiper control flow of the control unit 4 in the gestalt 1 of operation. First, at step 101, it judges whether the position of the actuation switch 5 is automatic mode, in the case of automatic mode, progresses at step 102, and, on the other hand, progresses to step 111 except automatic mode.

[0024] At step 102, it judges whether the vehicle speed pilot switch 6 has detected transit, when transit is detected, it progresses to step 103, and when transit is not detected, it progresses to step 112. In addition, at this step 112, intermittent time amount is set as maximum (for example, 20sec), infinity is also contained in this maximum, and it means stopping actuation of a wiper 3 as making intermittent time amount into infinity.

[0025] Photography sensitivity settling is performed at step 103. This photography sensitivity settling has the too bright image captured from the camera 1, or the average of the illuminance of 256 gradation is calculated [ in / specifically / are for adjusting so that too darkly, and / all pixels ], based on whether it has fitted in the suitable range (for example, the range of 70-180) set up beforehand, if too dark, sensibility will be raised, and if too bright, amendment which lowers sensibility will be performed. Thereby, it is a thing in order to eliminate the effect of the weather, or the effect of a tunnel, bearing, etc.

[0026] The image photoed with the camera 1 is captured at step 104. Edge enhancement processing is performed at continuing step 105. This edge enhancement processing is processing which makes light and darkness conspicuous, in order to make the optical part of a raindrop easy to detect, and processing which makes the edge part of an image conspicuous is performed by covering the edge enhancement filter which makes a difference with the pixel which adjoins each other about each of the input from each pixel emphasize.

[0027] At step 106, processing (this image is expressed with  $P_n$ ) which carries out memory of the signal which performed edge enhancement processing as mentioned above is performed. Coincidence image creation processing is performed at continuing step 107. This coincidence image creation processing is processing which extracts the image  $P_w$  which compares the last memory image ( $P_{n-1}$ ) with this memory image ( $P_n$ ), and is in agreement in both. That is, in the condition that the car is running and the wiper 3 is performing eradication actuation, the parts which are not in agreement in last time and this time among the image data inputted from the camera 1 can be judged to be a scene ahead of a car, and a motion of a wiper 3. To it, the data which are in agreement in last time and this time are the image of the front face of the front window 2 which is not changed to a camera 1, and it can be considered that the raindrop

adhering to this front face is shown. So, a coincidence image (Pw) is created at this step 107. In addition, this comparison is good also as not being limited to the comparison with last time and comparing with all the beforehand \*\*\*\* the comparison with second-from-last-time or beforehand \*\*\*\* or last time, and second from last time.

[0028] Next, at step 108, processing which carries out memory of this memory image Pn as Pn-1 for next coincidence image creation processing is performed. In addition, when said comparison compares with not only last time but second-from-last-time or beforehand \*\*\*\*, a comparison, or these [ all ], it carries out memory processing not only of this time but the second-from-last-time or beforehand \*\*\*\* for memory similarly.

[0029] Next, threshold processing is performed at step 109. That is, processing made into white or black about the input from each pixel as compared with a predetermined threshold is performed. In this case, when a pixel is 256 gradation, it all or more of 150 considers as white, and with 150 [ less than ], processing which is altogether made into black performs black-and-white-ization. This black-and-white-ized numeric value shows the amount of raindrops. That is, the part to which the raindrop has adhered reflects, it is processed as white, and the white number of pixels expresses the amount of raindrops. In addition, the threshold 150 of black-and-white-ized processing is not tuned up by experiment, and is not limited to these values.

[0030] Wiper intermittent time setting processing is performed at step 110. Namely, it is what counts the white number W of pixels at this step 110 based on the data black-and-white-ized in step 109, and sets up the intermittent time amount of a wiper based on the number W of pixels of that white. For example, the optimal intermittent time amount is chosen out of the operating time (it operates once to n times in 20 seconds) set up two or more steps by comparing said number W of pixels and two or more predetermined thresholds. It is desirable to give a hysteresis in the time of setting to the side made as long incidentally as the time of setting to the side which shortens intermittent time amount as this intermittent time amount becomes so short that the white number W of pixels is large and it is shown in drawing 4 .

[0031] At continuing step 111, wiper output processing is performed and the output according to either of the high mode raw mode wash modes is performed according to the position of the output according to the intermittent time amount set up at step 110, a halt set up at step 112, the output according to the maximum intermittent time amount, or the actuation switch 5. In addition, in the gestalt 1 of the operation explained above, it constituted so that it might be inputted into a control unit 4, but without going via a control unit 4 corresponding to these modes, the signal in the high mode raw mode wash mode of the actuation switch 5 may be constituted so that the direct motor 7 may be made to drive.

[0032] Next, actuation of the wiper equipment WM for cars of the gestalt 1 of operation is explained. With the gestalt 1 of this operation, if an operator operates the actuation switch 5, a control unit 4 makes a wiper 3 wipe away at high speed, when high mode is chosen, when the raw mode is chosen, it makes a wiper 3 wipe away at a low speed, and when wash mode is chosen, it will perform washing actuation (flow of step 101->111).

[0033] Moreover, when automatic mode is chosen by the actuation switch 5, it is made to operate as follows. first, the maximum intermittent time amount which includes a halt (intermittent time amount infinity) when, as for a control unit 4, the vehicle speed pilot switch 6 has detected the stop -- setting up (flow of step 101->102->112->111) -- when the vehicle speed pilot switch 6 has detected transit, intermittent time amount is set up according to the amount of raindrop detection.

[0034] First a setup of the intermittent time amount according to this amount of raindrop detection with a camera 1 The image Pn which performed edge processing which emphasizes the edge of an image to the image pick-up data which photoed the car front over the wiper eradication range of the front window 2, and were obtained by this, The image Pw which is in agreement by the image Pn-1 [ last ] is created, the scene ahead of a car and the image of a

wiper 3 which change every moment are eliminated, and processing used only as the image in which the raindrop adhering to the front window 2 is shown is performed. And this image Pw is black-and-white-ized, intermittent time amount is set up based on the white number W of pixels, and a motor 7 is made to drive based on this intermittent time amount (flow of step 101->102->103->104->105->106->107->108->109->110->111).

[0035] Since it constituted from a gestalt 1 of this operation in detecting the amount of raindrops so that the scene ahead of a car and the image of a wiper 3 might be deleted by extracting the part which is in agreement by this image Pn and image Pn-1 [ last ] as explained above The need of preparing a translucent film in the front window 2, or preparing comparison bodies, such as an emblem, in a bonnet and photoing this with a camera 1 so that a front scene may not be photoed with a camera 1 like the conventional technique is lost. A camera 1 Therefore, input means, such as a front monitor of an automatic traveller, white line detection, and number plate recognition, While combination becomes possible as an input means for making a lighting / putting-out-lights judgment of the lighting in automatic writing control and it is advantageous in cost The effectiveness that improvement in versatility can be aimed at is acquired, and the constraint to the installation location of a camera 1 decreases, and the effectiveness that a design degree of freedom improves is acquired.

[0036] Furthermore, since [ which performs image pick-up dimmer control whenever it performs actuation by automatic mode, if it is in the gestalt 1 of operation ] it constituted like (step 103), the effect of transit conditions, such as change of the weather and a tunnel, is amended, and the effectiveness that improvement in detection precision can be aimed at is acquired.

[0037] Moreover, since it constituted so that edge processing which makes the edge of an image conspicuous to the inputted image might be performed if it was in the gestalt 1 of operation, it becomes easy to detect the optical part of a raindrop, and improvement in detection precision can be aimed at further.

[0038] Furthermore, since the hysteresis was given in the setup of intermittent time amount in the time of lengthening with the time of shortening intermittent time amount as shown in drawing 4 if it was in the gestalt 1 of operation, intermittent time amount cannot change with dispersion in an input finely, and stability of actuation can be aimed at.

[0039] (Gestalt 2 of operation) Next, the gestalt 2 of operation is explained based on the flow chart of drawing 5 . Although a setup of intermittent time amount was changed by whether it is under [ transit ] \*\*\*\*\* with the gestalt 1 of operation based on detection of the vehicle speed pilot switch 6, with the gestalt 2 of this operation, the vehicle speed pilot switch 6 is abolished and it differs in the gestalt 1 of operation in that it is made to change intermittent time amount based on the set-reset of a rain flag. In addition, in explaining the gestalt 2 of this operation, at the step which performs the same processing as the gestalt 1 of operation, explanation is omitted by attaching the same number as the gestalt 1 of operation.

[0040] In the gestalt 2 of operation, it differs from the gestalt 1 of operation by the flow from a start to step 108 in that the step which judges the condition of the vehicle speed pilot switch 6 of step 102 is lost. Instead of the judgment based on this vehicle speed pilot switch 6, the raindrop distinction step of steps 300-308 is prepared following step 108.

[0041] First, at step 300, threshold-ized processing (black-and-white-ized processing) is carried out like step 109 of the gestalt 1 of operation of the coincidence image Pw formed in step 107, and the threshold-ized processing signal Pb is formed.

[0042] At step 301, if coincidence of a white part is 90% or more, while comparing this time value Pb of this threshold-ized processing signal Pb with last value Pn-1, and progressing to step 302, if coincidence of a white part is less than 90%, it will progress to step 306. In addition, in this comparison, the rate (%) whose white part corresponds is tuned up by experiment, and 90% is that example. Moreover, this comparison is not limited to the

comparison with last time, and is good also as all the comparison with second-from-last-time or beforehand \*\*\*\*, or a comparison with these.

[0043] Since having wiped away the front window 2 has much coincidence of white when it judges whether eradication actuation by the wiper 3 was performed at step 302 and eradication actuation is performed, a white pixel judges that it is not what shows rain, progresses to step 305, and sets to rain flag =0. On the other hand, when eradication actuation by the wiper 3 is not performed in step 302, a white pixel judges that the possibility which shows rain is high. And it progresses to step 110 and intermittent time amount is set up noting that it progresses to step 303 and it sees the set condition of a rain flag, and it is raining, if it is rain flag =2. The rain flag which it progresses to step 304 and is the 1st step of rain decision first on the other hand noting that rain possibility is high in step 303, when it is not rain flag =2 = processing set to 1 is performed. This rain flag = 1 is equivalent to temporary rain decision.

[0044] In step 301, when it judges whether it progressed to step 306 when there was little coincidence of white, and eradication actuation by the wiper 3 was performed and eradication actuation does not accomplish it, it progresses to step 305 noting that rain has not adhered. On the other hand, when the eradication actuation by the wiper 3 has accomplished, it is judged that rain possibility is high. That is, since the part of the white which shows rain stopped being in agreement when the wiper 3 performed eradication actuation, possibility that rain was wiped away by the wiper 3 is high. Then, it progresses to step 307 and judges how the rain flag is set first, and in being rain flag =0, the condition is maintained, and it progresses to step 112, and sets intermittent time amount to max. A rain flag when it is not rain flag =0 on the other hand = in the case of 1 or 2, after judging that rain has adhered, progressing to step 308 and setting to rain flag =2, it progresses to step 110 and intermittent time amount is set up.

[0045] As mentioned above, the gestalt 2 of operation compares a value this time value of the threshold processing-ized signal Pb after performing threshold processing, and last time. It is based [ whether there to be or much coincidence of a white part is few, and ] on whether eradication actuation by the wiper 3 was performed at the previous time. When it is made to judge the rain of the three-stage of rain flag =2 (rain decision), rain flag =1 (\*\*\*\* decision), and rain flag =0 (non-rain decision) in order with high rain possibility and this rain decision does not accomplish in it, in order to perform the maximum intermittent working, While being able to make a rain judgment in a high precision, when not raining, unnecessary eradication actuation is not performed.

[0046] As mentioned above, although the drawing explained the gestalt of operation, this invention is not limited to this. For example, although the gestalt of operation showed the example make a camera 1 use also [ example ] as an input means of a front monitor, automatic writing control, white line detection, and number plate recognition, it is not necessary to make it not necessarily use also [ control / these ].

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[Translation done.]

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, since it was necessary to prepare a translucent film in a front window with a technique given in former JP,10-90188,A, the installation location was restricted to the location where this film does not bar a field of view, while having the problem of being inferior to a design degree of freedom, the expensive image pick-up means became only for raindrop detection, and while it was noneconomic, it had the problem of being inferior to versatility. Namely, although research of automatic transit control is advanced, the image pick-up means is used for recognition of recognition of the car in front, the white line of a road, etc. or an image pick-up means is used for it in this control in recent years also as an input of control of lighting and putting out lights of lighting If it is difficult to use also [ control / these ] and it installs the image pick-up means only for each control, while becoming expensive, when there is no tooth space in which two or more image pick-up means are installed, it becomes impossible to install one of equipments, and becomes disadvantageous in respect of versatility.

[0004] moreover, with the technique of a publication, to latter JP,10-111249,A While installation of a comparison body with the need of preparing in the state of standing up on a bonnet is indispensable Since it was necessary to also install an image pick-up means towards this comparison body, even if it was in this technique, like the above, it could not be made to serve a double purpose as an input means of other control of an image pick-up means, but the application was restricted, and it had disadvantageously the problem that a design degree of freedom was low, in respect of economical efficiency and versatility.

[0005] This invention is making unnecessary the member it is made not incorporate the background of an image, while accomplishing paying attention to the above-mentioned conventional trouble and lessening constraint of the installation location of an image pick-up means, and constraint of the installation direction of an image pick-up means, and while making it possible to use an image pick-up means for other applications and planning improvement in a design degree of freedom, it aims at planning improvement in economical efficiency and versatility.

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MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention turns the eradication range of the wiper in the front window of a car ahead from back, and an image pick-up means is established possible [ photography ]. The control unit which detects a raindrop based on the image pick-up data inputted from this image pick-up means is prepared. This control unit It is characterized by comparing with the image pick-up data in former control timing the image pick-up data in this control timing inputted from an image pick-up means, and being constituted so that the amount of raindrops may be judged based on the image pick-up data which are in agreement in both.

[0007] It sets to the raindrop detection equipment for cars according to claim 1 like the publication to claim 2. In addition, said control unit Black-and-white-ized processing processed to white or black based on the comparison with the gradation of the light and darkness of each pixel and the threshold set up beforehand in said congruous image pick-up data may be performed, and you may constitute so that a white part may be dealt with as a raindrop and the amount of raindrops may be detected.

[0008] Moreover, you may constitute so that intermittent time setting processing in which are constituted so that wiper control according to claim 3 by which said control unit controls actuation of a wiper like in the raindrop detection equipment for cars according to claim 1 or 2 may be performed, and the intermittent time amount which is the eradication timing of a wiper is set up in this wiper control based on the detection result of the amount of raindrops may be performed.

[0009] It sets to the raindrop detection equipment for cars according to claim 3 like the publication to claim 4. Moreover, said control unit A transit detection means to detect whether a car is running as an input means is established. In performing said intermittent time setting processing, you may constitute so that intermittent time amount may be set as the maximum to which a car contains infinity during un-running and intermittent time amount may be set up during transit of a car on the other hand according to the detected amount of raindrops.

[0010] It sets to the raindrop detection equipment for cars according to claim 2 like the publication to claim 5. Moreover, said control unit When the rate that it is in agreement in the part of this white and the part of former white immediately after the eradication by the wiper accomplished decreases When there are many rates that it is in agreement in the part of this white and the part of former white when it judges with a rainfall and eradication by the wiper does not accomplish, it judges with a temporary rainfall. In the wiper control which performs rainfall judging processing judged to be a non-rainfall when there are many rates that it is in agreement in the part of this white and the part of former white, and controls actuation of a wiper further immediately after eradication by the wiper At the time of a temporary rainfall judging and a non-rainfall judging, the intermittent time amount which is the eradication timing of a wiper may be set as the predetermined maximum containing infinity, and at the time of a rainfall judging, you may constitute so that intermittent time setting processing in which

intermittent time amount is set up according to a white area may be performed.  
[0011]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the general drawing showing the configuration of the wiper equipment WM for cars of the gestalt of operation.

[Drawing 2] It is the flow chart which shows the Main flow of the gestalt of operation.

[Drawing 3] It is the flow chart which shows the wiper control including raindrop detection of the gestalt 1 of operation.

[Drawing 4] It is the intermittent time amount property Fig. of the gestalt 1 of operation.

[Drawing 5] It is the flow chart which shows the wiper control including raindrop detection of the gestalt 2 of operation.

[Description of Notations]

1 CCD Camera

2 Front Window

3 Wiper

4 Control Unit

5 Actuation Switch

6 Vehicle Speed Pilot Switch

7 Motor

WM Wiper equipment for cars

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[Translation done.]